Visualizing Software Dynamics

Fabian Beck

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https://vssp.github.io/
III. Visualizing the Evolution of Executions

I. Visualizing Software Evolution

II. Visualizing Software Execution

IV. Challenges

Software Dynamics
I. Visualizing Software Evolution
Observation 1.1: **Changes of low-level structures provide a first picture**

Observation 1.2: High-level structures change as well

Observation 1.3: Recent history is often an important context

Embedding Evolutionary Context

II. Visualizing Software Execution
State of the Art of Performance Visualization

Katherine E. Isaacs\textsuperscript{1}, Alfredo Giménez\textsuperscript{1}, Ilir Jusufi\textsuperscript{1}, Todd Gamblin\textsuperscript{2}, Abhinav Bhatel\textsuperscript{2}, Martin Schulz\textsuperscript{2}, Bernd Hamann\textsuperscript{1}, and Peer-Timo Bremer\textsuperscript{2}

\textsuperscript{1}Department of Computer Science, University of California, Davis
\textsuperscript{2}Lawrence Livermore National Laboratory
Observation 2.1: Visualizing **changing** execution data is challenging due to scale and variance

Embedding Performance Context

Observation 2.2: The code is necessary context to comprehend performance information

Observation 2.3: Natural-language text can explain and help better comprehend complex runtime data.
III. Visualizing the Evolution of Executions
**Execution**
- Time: ms – min
- Data:
  - Call graph
  - Object graph
  - Performance
  - Memory

**Evolution**
- Time: h – years
- Data:
  - Changes
  - Commits
  - Developers
  - Issues
Stored Procedures of a Data Warehouse

Observation 3.2: Diverse **context** is necessary to **comprehend** performance regressions

**Context:**
- Modularization
- Dynamic calls
- Execution timelines
- Code diffs
Observation 3.3: *Interactively changing* a system and exploring the (predicted) effects of changes is desired.
IV. Challenges

Change
- History: What happened?
- Future: What if?

Context
- What context information is required?
- How to integrate required data sources and analysis methods?

Comprehension
- How to present the analysis in a understandable and self-explaining way?
Visualizing Software Dynamics

Change  Context  Comprehension

Thank you!
Fabian Beck
fabian.beck@paluno.uni.due.de
@beck_fabian
**Abstract:** Software is not just a static set of code fragments, it is dynamic – programs show dynamic behavior when being executed and software systems evolve over time. This talk introduces how visualization helps better understand and analyze these two dimensions of software dynamics. I present both architecture-centric overview visualizations and detailed code-centric visual representations to support various software maintenance and performance engineering tasks. Finally, I discuss challenges for leveraging the two dynamic dimensions within integrated visualizations.

**Biography:** Fabian Beck is assistant professor at the University of Duisburg-Essen, Germany. He received the Dr. rer. nat. (PhD) degree in computer science from the University of Trier, Germany in 2013. He worked as a postdoctoral researcher at the University of Stuttgart Visualization Research Center (VISUS) until 2016. His research focuses on methods for visualizing and comparing large and dynamic graphs and hierarchies, often in the context of software systems, their evolution, and execution behavior. He also investigates visual analytics systems and the integration of visualizations into text documents.